Before the
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

In the Matter of	)	
	)	
Flexibility for Delivery of Communications by	)	
Mobile Satellite Service Providers in the 2 GHz	)	IB Docket No. 01-185
Band, the L-Band, and the 1.6/2.4 GHz Bands	)	

INMARSAT OPPOSITION TO PETITION FOR PARTIAL RECONSIDERATION AND CLARIFICATION OF MOBILE SATELLITE VENTURES SUBSIDIARY LLC

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SUMMARY

Even before a single ancillary terrestrial component ("ATC") system has been authorized, Mobile Satellite Ventures LLC ("MSV"), in its petition for partial reconsideration and clarification, seeks to substantially revise the Commission's ATC service rules in a manner that will cannibalize MSV's satellite operations and cause harmful interference into Inmarsat's mobile satellite service ("MSS") network. For over two years, the Commission and Inmarsat have relied upon MSV's representations regarding its proposed ATC system and, based on those representations, analyzed the potential interference impact of ATC in the L-band. As a result, the Commission's recent order in this proceeding authorized ATC in the L-band subject to service rules that are intended to (i) protect MSS operations from unacceptable interference and (ii) ensure that ATC remains ancillary to the ATC operator's principal MSS service. Now, in its petition, MSV has backed away from its prior commitments to (i) limit the link margin degradation to MSV's satellite caused by its own ATC operations; (ii) ensure that its ATC operations contribute no more than 1% $\Delta T/T$ to Inmarsat's satellites; (iii) reuse ATC channels a maximum of 2000 times CONUS-wide; and (iv) use specially developed ATC base stations antennas to limit interference into MSS mobile earth terminals ("METs").

The Commission determined that in order to protect Inmarsat's satellites from uplink interference, MSV should be permitted no more than 1725 co-frequency ATC base station carrier reuses on a 200 kHz channel in the U.S. This would limit the self-interference into MSV's satellite to no more than 0.25 dB and, according to the Commission, protect Inmarsat's satellites from harmful interference. MSV inappropriately seeks to increase this limit to 3450 reuses by arguing that its plans to limit its ATC operations outside the U.S. should correlate to an increase in the number of allowable ATC reuses within the U.S. Nowhere in the *ATC Order*,

however, does the Commission's analysis support such a result. If the number of ATC base stations were to increase above the limit established by the Commission, the higher density of ATC mobile terminals ("MTs") would result in a greater amount of interference into both MSV's and Inmarsat's satellites than permitted under the *ATC Order*. Moreover, the Commission's reuse limit appropriately recognizes that ATC may be authorized outside the U.S. and that Inmarsat would need to be able to accommodate aggregate ATC interference from such countries. The adopted reuse limit, if it is modified as requested in Inmarsat's petition for reconsideration, is consistent with MSV's original proposed ATC system.

MSV further seeks to increase the 1725 reuse limit and expand its ATC operations by increasing to 51% the level of self-interference that it would accept into its satellite from ATC operations. This proposal on its own corresponds to an increase in the reuse limit to 14,785 – combined with the proposed doubling of reuses it could lead to as many as 29,570 reuses. This dramatic increase in the level of self-interference would correspondingly increase the interference into Inmarsat's satellites far above acceptable levels. The interference margin in Inmarsat's satellite system is limited and is necessary for satellite coordination. The increase in interference sought by MSV is inconsistent with its previous representations and would significantly tax Inmarsat's operations and ability to coordinate spectrum. Moreover, such an increase in self-interference would result in the cannibalization of MSV's MSS system. MSV's justifications and proposed solutions to the self-interference problems are not credible and could result in MSV either operating a primarily terrestrial-based service or attempting to coordinate additional L-band spectrum in contravention of the *ATC Order* and the Mexico City MOU.

MSV requests that the Commission modify the vocoder interference reduction factor the Commission has adopted. MSV's proposal, however, is specious and would result in the double counting of the interference reduction due to power control.

Based on inappropriately conducted tests that ignore crucial degradation effects on the performance of Inmarsat METs, MSV also requests a relaxation of the rules that the Commission adopted to protect Inmarsat's METs from interference generated by ATC base stations. As discussed in the attached Technical Annex, MSV's test analysis is significantly flawed. Inmarsat has provided reports by two separate Inmarsat receiver manufacturers in its petition for reconsideration and urges the Commission to recalculate the MET protection levels based on those reports.

MSV seeks to relax the required level of overhead gain suppression on ATC base stations because the mask specifications that MSV itself proposed are allegedly now difficult to meet and expensive. The Commission adopted the overhead gain suppression restrictions based on detailed analyses performed by the Commission and the parties in this proceeding and MSV's prior submission from its antenna manufacturer, CSS Antenna, that antennas meeting such performance levels are "a very cost effective choice for large scale Base Station deployment." The restrictions protect the operation of terminals that provide important safety and navigations functions and should not be changed at this late point because MSV now claims that the antenna mask it advocated may cost more than anticipated.

Inmarst urges the Commission to maintain both the PFD level and location restrictions on ATC base stations that the Commission adopted to protect Inmarsat aeronautical terminals in the vicinity of airports. Contrary to MSV's assertions, both restrictions are vital to protect the aeronautical terminals, which provide important safety and navigation services.

Finally, MSV's late request for a "clarification" that non-forward-band ATC operations are permitted in the L-band should be rejected. Non-forward-band ATC operations would result in a direct interference from the ATC MT to the receiving MSS MET. This would represent a whole new interference scenario in the L-band and could result in catastrophic levels of interference. Therefore such operations should be prohibited.

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INMARSAT OPPOSITION TO PETITION FOR PARTIAL RECONSIDERATION AND CLARIFICATION OF MOBILE SATELLITE VENTURES SUBSIDIARY LLC

Inmarsat Ventures plc ("Inmarsat") hereby files this Opposition to Mobile Satellite Ventures Subsidiary LLC's ("MSV's") Petition for Partial Reconsideration and Clarification in the above-cited proceeding.[1] In its petition, MSV has revealed its true colors and advocated for the expansion of its proposed ancillary terrestrial component ("ATC") system in a manner that would dramatically undermine the "ancillary" aspect of ATC and interfere with mobile satellite service ("MSS") operations in the L-band. Even before a single ATC system is authorized, MSV seeks to substantially revise the Commission's ATC service rules in a manner that would cannibalize MSV's satellite operations and cause harmful interference into Inmarsat's MSS network. If MSV's petition were granted, MSV would be able to rollout a predominantly terrestrial system that would adversely impact all MSS operations in the L-band.

BACKGROUND

In January 2001, MSV filed an application to launch a next generation satellite in which it requested authority to integrate ATC into its MSS operations.[2] In its application and in numerous *ex parte* submissions for the next two years, MSV described the ATC system that it

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1 *Petition For Partial Reconsideration and Clarification of Mobile Satellite Ventures Subsidiary LLC*, IB Docket No. 01-185 (filed July 7, 2003) (the "*MSV Petition*").

2 *See MSV Petition* at 2-3.

sought to deploy. Fundamental to MSV's claims was that the ATC system would (i) remain truly ancillary and (ii) not cause significant levels of interference into any MSS system, including its own. To this end, MSV made specific representations about its proposed ATC system including: (i) limiting the link margin degradation to MSV's own satellites;[3] (ii) contributing no more than a 1% ΔT/T to Inmarsat's satellites;[4] (iii) reusing ATC channels a maximum of 2000 times CONUS-wide;[5] and (v) using specially developed ATC base station antennas to limit interference into MSS mobile earth terminals ("METs").[6] Based on MSV's description of and representations regarding its proposed ATC system, the Commission and Inmarsat conducted extensive technical analysis detailing the potential interference that ATC could cause to Inmarsat's current and next-generation satellite systems.[7] Specifically, Inmarsat

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3 *See, e.g.,* Letter from MSV to Secretary, FCC, *ex parte* entitled *"MSV's Next Generation Satellite System Coordination and Interference Considerations,"* IB Docket No. 01-185 at 4, 21 (filed February 6, 2002) (*"February 5, 2002 MSV Presentation"*); *Comments of Mobile Satellite Ventures Subsidiary LLC*, IB Docket No. 01-185 at Figure 5 (filed March 22, 2002) (*"March 22, 2002 MSV Comments"*); *"Monitoring and Control of Ancillary Terrestrial Emissions by MSV's Space Segment"* prepared by Peter Karabinis, VP & Chief Technical Officer of MSV, *ex parte* presentation of MSV, IB Docket No. 01-185 at 11 (filed March 28, 2002) ("MSV demonstrated that only 0.25 dB of link margin need be expended by its SS links to accommodate the (intra-system co-channel effect of the ATC.") (*"Karabinis Paper"*); Letter from MSV to Secretary, FCC, *ex parte* letter, IB Docket No. 01-185 at Ex. A p. 4 (filed January 13, 2003) (*"January 13, 2003 MSV Presentation"*).

4 *See, e.g., February 5, 2002 MSV Presentation* at 5; *January 13, 2003 MSV Presentation* at Ex. A, p. 5.

5 *See, e.g., March 22, 2002 MSV Comments* at Figure 6; *January 13, 2003 MSV Presentation* at Ex. A, p. 25.

6 *See, e.g., Reply Comments of Motient Services Inc., TMI Communications and Company, Limited Partnership, and Mobile Satellite Ventures Subsidiary LLC*, IB Docket No. 01-185 at 15-16 and CSS Antenna affidavit attached thereto (filed November 13, 2001) (*"Reply Comments of MSV"*) ("This makes this antenna a very cost effective choice for large scale Base station deployment.").

7 *See, e.g., Comments of Inmarsat Ventures plc*, IB Docket No. 01-185 (filed October 19, 2001) and *Technical Annex* thereto; *Reply Comments of Inmarsat Ventures plc*, IB

demonstrated how ATC in the L-band could cause harmful in-band and out-of-band interference to Inmarsat satellites and METs, if not appropriately constrained.

The Commission carefully considered the input of commenters on whether to open the L-band to ATC and as well as the deployment of the ATC system specifically proposed by MSV. More than two years after MSV filed its application, the Commission issued an order authorizing the deployment of ATC, but only under specific conditions.[8] The Commission's ATC rules serve two major functions: (i) protecting MSS operations from unacceptable interference caused by ATC[9]and (ii) ensuring that ATC remains ancillary to the ATC operator's principal MSS service.[10]

In its petition for reconsideration, MSV contradicts its previous representations. In so doing, MSV attempts to dramatically increase the terrestrial aspect of its future hybrid MSS/ATC network at the expense of its own MSS system as well as Inmarsat's satellite network. For example, where MSV once sought no more than 2000 co-frequency ATC reuses of the same 200 kHz channel CONUS-wide, it now asks the Commission to allow up to 14,785 reuses.[11]

Docket No. 01-185 (filed November 13, 2001), and *Supplemental Technical Annex* thereto; *"Quantification of harmful Co-Channel L-Band Uplink Interference into Inmarsat-4 From MSV ATC Uses, Versus MSV Mobile Earth Terminal Uses," ex parte* presentation of Inmarsat, IB Docket No 01-185, (filed May 10, 2002); *"Inmarsat's Reply to 'Further Technical Analysis' of Mobile Satellite Ventures, dated July 29, 2002," ex parte* presentation of Inmarsat, IB Docket No 01-185, (filed September 9, 2002).

8 *See Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands, Report and Order*, 18 FCC Rcd 1962, FCC 03-15, IB Docket 01-185 (February 10, 2003) ("*ATC Order*").

9 *See, e.g., ATC Order* at ¶ 131 ("MSV's use of ATC consistent with the operational restriction adopted herein will be capable of protecting the current and future generation Inmarsat satellite networks from unacceptable interference.").

10 *See, e.g., ATC Order* at ¶ 1 ("We will authorize MSS ATC subject to conditions that ensure that the added terrestrial component remains ancillary to the principal MSS offering.").

11 *See MSV Petition* at 15.

MSV further asserts that because it plans to "apply 80% of its ATC network in the U.S." (and 20% outside the U.S.), the Commission should allow MSV to further increase the level of permitted reuses within the U.S. to 23,657.[12] That is a level of reuse almost 14 times higher than that adopted in the *ATC Order*! MSV's rationale leads to the further absurd conclusion that if MSV were to promise the Commission to deploy 100% of its ATC stations in the United States, the total number of ATC base stations would be 29,570 – more than 17 times higher than specified in the *ATC Order*. To increase the terrestrial aspect of its operations, MSV now seeks to deploy ATC in a manner that would dramatically increase the permissible interference from U.S.-based ATC stations into both Inmarsat's satellites and MSV's own satellites[13] – the increased interference levels would be far in excess of the values specified by the Commission in the *ATC Order*, and far in excess of acceptable values, as discussed below.

DISCUSSION

MSV requests a series of changes in the *ATC Order* that, if adopted, would undermine the necessary protections that have been established to constrain ATC interference into Inmarsat's MSS network. Many of the changes requested by MSV are merely restatements of arguments previously made in this proceeding that were considered and properly rejected by the Commission. Thus, these arguments should be summarily dismissed as repetitive.[14] To the extent that MSV has raised new issues in its petition, the modifications requested would cause

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12 *See MSV Petition* at 6.

13 *See id.* at 10-11.

14 *See Amendment of Section 73.202(b), FM Table of Allotments, FM Broadcast Stations*, Memorandum Opinion and Order, 16 FCC Rcd 2272 at 1 (Jan. 26, 2001) ("the Petition for Reconsideration is repetitive with respect to matters already considered in the *Report and Order*. We will not again consider or debate these matters.").

significant harm to Inmarsat's satellite operations and would set the stage for MSV deploying a predominantly terrestrial-based system.

I. INMARSAT'S SATELLITES MUST CONTINUE TO BE PROTECTED FROM UPLINK BAND INTERFERENCE AS CONTEMPLATED BY THE *ATC ORDER*

The Commission recognized the potential for harmful uplink interference into Inmarsat's satellites from the deployment of ATC base stations and use of ATC mobile terminals ("MTs"). To ameliorate this concern, MSV repeatedly represented in its *ex parte* filings that it would "limit the number of transmitting ATC users on its own network by measuring the increased noise-floor of its satellite receiver and adhere to a maximum increase in the satellite noise floor of 0.25 dB."[15] MSV argued that Inmarsat would suffer even less interference than MSV. In fact, MSV further represented that its proposed ATC system would cause less than a 1% increase in the noise floor of Inmarsat satellites.[16]

Relying upon these and other representations of MSV,[17] the Commission analyzed the potential interference that MSV's proposed ATC system could cause to Inmarsat's MSS service and determined that limiting the noise floor increase to an MSV satellite to 0.25 dB as suggested by MSV would sufficiently protect Inmarsat's satellites from co-channel uplink interference. The Commission determined that a 0.25 dB (6%) increase in the noise floor of an MSV satellite due to ATC self-interference would result in an increase in the noise floor of Inmarsat's satellites of between 0.7% and 3.4%, depending on the calculation methodology.

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15 *See Order* at App. C2 § 1.14; *see also, e.g., February 6 MSV Presentation* at 4, 21; *March 22 MSV Comments* at Figure 5; *Karabinis Paper* at 11; *January 13 MSV Presentation* at Ex. A, p.4.

16 *See, e.g., February 5, 2002 MSV Presentation* at 5; *January 13, 2003 MSV Presentation* at Ex. A, p.5.

17 *See Order* at ¶ 136, App. C2 § 1.2 ("MSV has stated that it will limit its intra-system interference (self-noise from its own ATC system) to an increase in noise of 0.25 dB") (citing *MSV January 10, 2002 Ex Parte Letter*, IB Docket 01-185 at 4).

The Commission recognized that it would be difficult, if not impossible, for MSV to reliably measure a 0.25 dB increase in noise floor and thus determined that an alternative method should be used to ensure that this limit was not reached. The Commission achieved its desired result by limiting the number of ATC base stations permitted to operate simultaneously on a given channel.[18] Specifically, the Commission limited to 1725 the number of co-frequency ATC base station carriers allowed to operate simultaneously on a 200 kHz channel.[19] By capping the number of ATC base station reuses in this manner, the Commission intended to ensure that noise increase to the MSV satellite would be limited to 0.25 dB[20] and that Inmarsat's satellites would be protected from excessive uplink interference caused by ATC operations.[21]

A. MSV Inappropriately Seeks To Double The Number Of Co-frequency ATC Base Station Transmissions

The Commission established a clear limit of 1725 base station carrier reuses inside the U.S. In its analysis, the Commission suggested that, if MSV implemented ATC

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18 *See Order* at App. C2 § 1.14.

19 *See Order* at ¶ 187 ("To ensure that MSV's ATC operations will not cause unacceptable interference to other MSS systems, we adopt section 25.253(c) to limit the number of co-frequency base stations to 1725 which is less than the 2000 proposed by MSV."). In its petition for reconsideration and clarification, Inmarsat requested that this limit be recalculated because of the Commission's use of an incorrect MSV satellite gain number in the Commission's analysis. *See Petition for Reconsideration and Clarification of Inmarsat Ventures PLC*, IB Docket No. 01-185 at 11-12 (July 7, 2003) ("*Inmarsat Petition*").

20 *See Order* at ¶ 145.

21 As discussed in the *Inmarsat Petition*, the Commission's interference analysis is consistent with Inmarsat's analysis once one (i) takes into consideration the Commission's requirement that an ATC system must reserve at least a certain amount of ATC MT transmit power to overcome structural attenuation and may not use that "reserve" power margin to provide outdoor service or to extend coverage at the edge of an ATC "cell" and (ii) recalculates the Commission's limitation using the MSV's own estimate of the sensitivity to interference of its next-generation satellite. *See Inmarsat Petition* at 3-4, 7-12.

outside of the U.S., it might be able to achieve additional reuses outside the U.S.[22] Using a bit of sophism, MSV argues in its petition that "the Commission effectively authorized a system-wide reuse factor of 3450."[23] MSV then goes on to state that it intends to operate 80% of its ATC network within the U.S. and thus should be permitted a U.S.-wide reuse factor of 2760. This proposition is absurd.

Nowhere in the *ATC Order* does the Commission conduct an analysis that establishes that, within the U.S., 3450 ATC base stations could operate simultaneously on a 200 kHz channel without increasing the noise floor in the ATC operator's satellite beam by 6%. As explained in Section 2.1 of the Technical Annex attached hereto,[24] the Commission's co-channel interference analysis is based on the assumption of an essentially uniform distribution of ATC MTs throughout the U.S. If the number of ATC base stations were to increase above the 1725 limit established by the Commission, the higher density of MTs would raise the MSV satellite noise floor by more than 0.25 dB, at least for some satellite beams.

The 1725 reuse limit imposed by the Commission also recognizes the need to anticipate and accommodate the potential actions of other administrations. The Commission has no authority to limit the deployment of ATC base stations that are authorized by the regulatory authorities in Canada, Central America, the Caribbean or South America. As the Commission noted in its analysis, Inmarsat is susceptible to the aggregate affects of ATC uplink interference

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22 *See ATC Order* at C2 § 2.1.1.

23 *See MSV Petition* at 5-6.

24 To the extent necessary, Inmarsat request that the Commission waive its 25-page limitation regarding oppositions to petitions for reconsideration in order to consider the attached reports. *See* 47. C.F.R. § 1.429(f). Due to the voluminous technical annexes attached to the *MSV Petition*, a waiver would serve the public interest by allowing the meaningful consideration of the issues discussed therein.

over a large area over the Americas.[25] Even if MSV promises that it will not deploy ATC outside of the U.S., foreign administrations will still have the ability to authorize MSV and other L-band operators to deploy ATC in their jurisdictions. In order to adequately protect Inmarsat from aggregate uplink interference, the Commission appropriately anticipated ATC deployment outside the U.S. when setting the co-frequency reuse limit applicable within the U.S.

There is no basis for allowing MSV to "rebalance" its deployment of ATC between Canada and Mexico at this late point. MSV's new plan to allow 2760 reuses of ATC base stations carriers directly contradicts its prior commitment that the maximum CONUS-wide frequency reuse for its proposed ATC system would be 2000.[26] The Commission had a rational basis for establishing the limits set forth in the *Order* based on its interference analysis, MSV's representations, and the international considerations inherent in an uplink interference analysis in the L-band. Inmarsat urges the Commission to reject this attempt to adjust the number of co-frequency base station carrier reuses in the U.S. based on commitments made by a potential ATC applicant as to how it intends to deploy ATC outside the U.S.

B. Self-Interference Restrictions Are Necessary To Avoid Unacceptable Interference Into Inmarsat Satellites And To Ensure ATC Remains An Ancillary Service

MSV argues on reconsideration that the Commission based its uplink interference analysis on the "erroneous premise that MSV's next-generation satellite must be protected to a level of 6% $\Delta T/T$ (*i.e.,* 0.25 dB rise in the noise floor) from the operation of its own L-band ATC MTs."[27] MSV fails to acknowledge, however, that it raised this argument during the course of

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25 *See ATC Order* at C2, Figures 1.11.A and 1.11.B.

26 *See, e.g., March 22 MSV Comments* at Figure 6; *January 13 MSV Presentation* at Ex. A, p.25.

27 *See MSV Petition* at 10.

the proceeding[28] and ultimately, the argument was rejected by the Commission. MSV offers nothing new in its petition and therefore its petition should be denied. For the sake of completeness, however, Inmarsat responds below to the specific points raised by MSV.

1. MSV Should Not Be Permitted To Deploy ATC In A Manner That Causes Unacceptable Interference Into Inmarsat Satellites

In its petition, MSV states that it would like to deploy ATC in a manner that would "allow co-channel L-band ATC MTs to impact Inmarsat-4 satellite to a level of 6% ΔT/T" and that MSV is willing to accept a 51% increase in self-interference.[29] In support of this dramatic change, MSV wrongfully asserts that "there is no record evidence to support that Inmarsat needs" a level of 1.4% ΔT/T interference protection.[30] To the contrary, Inmarsat has repeatedly demonstrated why ATC deployment should not be allowed to produce more than 1% increased interference into any Inmarsat satellite and that the 6% ΔT/T sought by MSV would cause a serious degradation in the overall performance of the Inmarsat MSS system.[31] Moreover, Inmarsat has explained why the COMTEK Associates Inc. study (which never was submitted

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28 *See, e.g.,* Letter from MSV to Secretary, FCC, ex *parte* letter, IB Docket no. 01-185 at 1 (filed January 28, 2003) ("*January 28, 2003 MSV ex parte*"); Letter from MSV to Secretary, FCC, ex *parte* letter, IB Docket No. 01-185 at 2 (filed January 24, 2003); Letter from MSV to Secretary, FCC, ex *parte* letter, IB Docket no. 01-185 at 1 (filed January 21, 2003).

29 *See MSV Petition* at 10. Using the Commission's calculation methodology, a 51% increase in the MSV noise floor due to ATC interference would result in between 6% and 29% increase in the Inmarsat noise floor. Therefore, MSV's assertion that there would be a 6% increase in the Inmarsat noise floor due to a 51% increase in interference to MSV's satellite is highly suspect. *See* Technical Annex § 2.2.

30 *See MSV Petition* at 12.

31 *See, e.g.,* Letter from Inmarsat to Secretary, FCC, *ex parte* presentation entitled "*Terrestrial Use of the L-Band,*" IB Docket No. 01-185 at 17 (filed November 5, 2002); Letter from Inmarsat to Secretary, FCC, *ex parte* letter, IB Docket No. 01-185 at 2-3 (filed January 10, 2003); Letter from Inmarsat to Secretary, FCC, *ex parte* letter, IB Docket No. 01-185 at 1-2 (January 23, 2003).

into the record of this proceeding) was wrong when it asserted that Inmarsat should be able to accept a 13.7% ΔT/T thermal noise degradation.[32]

The interference margin in satellite systems is very limited and does not normally take into consideration interference due to a non-conforming terrestrial use such as ATC that is not contemplated by the international table of frequency allocations. Consistent with ITU recommendations, Inmarsat generally allows for about a 25% increase in its noise floor due to interference from all external interference sources. As to any single satellite network, Inmarsat uses a 6% increase in noise as the basis for satellite coordination.[33] Only in extraordinary cases involving unlikely events have exceptions been made to enable increased satellite reuse of spectrum, and then only after a detailed analysis.[34]

The number of satellites operating in the L-band is increasing and a reasonable amount of interference must be allotted to each interferer for satellite coordination prior to allocation for interference from a non-conforming use, such as ATC. If U.S.-only ATC interference was permitted to create a 6% ΔT/T into Inmarsat's satellites, it would consume approximately 25% of Inmarsat's overall aggregate interference margin and result in significant operational and capacity constraints on Inmarsat's use of the L-band for MSS services. And this would not account for increased interference from other countries such as Canada, which also may allow MSV to deploy ATC.

It is also important to remember that ATC is an ancillary component of an MSS network and as such the interference from the ATC should be included in the interference

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32 *See* Letter from Inmarsat to Secretary, FCC regarding COMTEK Report, *ex parte* presentation of Inmarsat, IB Docket No. 01-185 (filed December 19, 2002).

33 *See, e.g.,* Recommendation ITU-R M.1183.

34 *See* Technical Annex § 2.2.

allowance for the MSS system. Furthermore, throughout this proceeding Inmarsat has pointed out the importance of ensuring that ATC interference is at a level that is small relative to the interference caused by the satellite component of the MSS/ATC network.[35] The Commission's analysis shows that, with the adopted limits, this would be the case in the U.S.[36] In this situation, Inmarsat can coordinate its satellite network with MSV and other operators without having to make significant allowance for the interference contribution from ATC. That could ensure that there is no loss of spectrum efficiency for the MSS systems operating in the L-band. However, if the number of permitted co-frequency reuses is increased, as proposed by MSV, this situation will change dramatically. If the interference from ATC were allowed to reach similar levels to the interference from the satellite component, ATC interference effects could no longer be ignored in satellite coordination and the frequency reuse between satellite systems would be degraded.

2. MSV Should Not Be Permitted To Deploy ATC In A Manner That Dramatically Increases Self-Interference

MSV's pointing to a "lack of record" regarding the harm associated with increasing the noise floor to Inmarsat's satellites is ironic, and possibly disingenuous. Until late in the proceeding, MSV itself promised that its "fully-loaded, mature ATC operations" would

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35 The Commission agrees with this premise, while disagreeing with Inmarsat's proposed 1% ΔT/T limit for ATC. *See ATC Order* at ¶ 164 ("We conclude that as long as the increase in receiver noise from the ATC is significantly less than the increase in noise resulting from the MSS operations, that sharing is feasible, and we disagree with Inmarsat's suggested 1% limit."). Presumably, the Commission bases its disagreement with the 1% limit on the assumption that the acceptable ΔT/T from satellite interference is greater than 6%. However, as explained in the Technical Annex, this is not a realistic assumption. *See* Technical Annex at § 2.2.

36 *ATC Order* at App. C2, Table 2.2.1.C.

cause "no more than one percent contribution" to the interference into Inmarsat satellites.[37] Only in the last few months prior to the release of the *ATC Order* did MSV do an "about face" and indicate that its previous promises were merely "descriptive" and not intended to be taken as prescriptive of appropriate limits.[38]

With the filing of its petition, MSV's strategy has become clear – it plans to cannibalize its MSS service for the sake of deploying a primarily terrestrial service. Once it claimed that "MSV's own satellite will be more vulnerable to MSV's ancillary operations than any other system. This fact actually protects Inmarsat's and other L-band users because it will be in MSV's own interest to monitor the aggregate ancillary signal level reaching its own satellites and moderate ancillary traffic in response, thereby eliminating even the remote possibility of generating harmful interference."[39] MSV also repeatedly assured that its ATC operations would cause no more than 6% $\Delta T/T$ interference into its own satellites. Now MSV is advocating for ATC deployment that would result in an increase in self-interference of 51% $\Delta T/T$, an increase in over 8 times the levels represented by MSV throughout this proceeding.[40]

MSV attempts to justify the proposed increase in interference by arguing that (i) the MSV satellite will have at least 10 dB of available uplink margin and thus can accommodate the proposed 1.8 dB increase in noise floor, and (ii) MSV has another "proprietary" technique to overcome the fundamental interference problems of its proposed ATC system.[41] As discussed in Section 2.2 of the attached Technical Annex, these claims are highly questionable. Link margin

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37 *See, e.g., February 5, 2002 MSV Presentation* at 5; *January 13, 2003 MSV Presentation* at Ex. A, p.5.

38 *See, e.g., January 28, 2003 MSV ex parte* at 1.

39 *Reply Comments of MSV*, Technical Annex at 4.

40 *See MSV Petition* at 10-11.

41 *See MSV Petition* at 11.

is an expensive commodity in the operation of a satellite and to apportion 1.8 dB to ATC uplink interference defies common sense. To accommodate such an apportionment, MSV would either (i) need to effectively increase the transmit power of the ATC handheld mobile terminals by more than 50% (which would adversely impact terminal cost, power consumption and presumably attractiveness to consumers) or (ii) build a much more expensive satellite with a larger number of satellite beams than would otherwise be necessary.[42]

MSV's claim that it is "considering options" including a new proprietary "two in-orbit satellite system" is also highly suspect. MSV makes no promises in its petition and, even if it did, the *MSV Petition* and MSV's other actions in this proceeding demonstrate that such promises are only good until they become inconvenient for MSV. Without additional specifically detailed information about this "two in-orbit satellite system," Inmarsat can only observe that any conceivable designs would be complex and expensive -- two hurdles that MSV has consistently tried to avoid in advocating for ATC.[43]

As Inmarsat has warned in the past, increases in self-interference into MSV's MSS operations will either decrease the quality of MSV's satellite service or increase its need for additional spectrum. If MSV is willing to allow the quality of its satellite service to decline, this would be highly indicative of MSV's strategy to move to a predominantly terrestrial service. And any hope that MSV could coordinate additional spectrum in operator negotiations under the Mexico City MOU to replace the spectrum that it lost to self-interference was quashed in the *ATC Order*. As the Commission indicated in the *ATC Order*, spectrum demands based on ATC

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42 *See* Technical Annex § 2.2(a).

43 *See* Technical Annex § 2.2(b).

usage should not be permitted.[44] Increasing the level of permitted self-interference as proposed by MSV therefore is contrary to the dictates of the *ATC Order*.

In order to ensure that ATC remains ancillary in the L-band, it is vital that the Commission continue to limit ATC operations based on the level of uplink interference that ATC will cause to MSV's own satellite.

3. Self-interference Based ATC Limitations Are Reasonable Due To The Unique Coordination Obligations On L-band Operators

Limiting the deployment of ATC based on the level of self-interference caused by the ATC operator is consistent with the unique coordination requirements of the L-band. Under the Mexico City MOU, MSS operators in the L-band are required to coordinate the use of spectrum in the L-band every year based on the demonstrated need of the operators for spectrum currently and in the coming year. Unlike in the 2 GHz and Big LEO bands, the L-band operators must be flexible and be prepared to use different spectrum bands from year to year. Moreover, they are given the opportunity to work out coordination agreements that allow more or less interference into another operator's system depending on how satellite operations are actually deployed. By protecting MSS operations from ATC operations in the L-band based on self-interference restrictions, the Commission devised a method of protecting L-band MSS operators from interference and ensuring that ATC remains ancillary, while allowing L-band operators the flexibility to best coordinate spectrum usage under the Mexico City MOU. Contrary to MSV's assertion,[45] the use of self-interference restrictions to limit the deployment of ATC in the L-band is an elegant and rational solution to complex problems presented by ATC usage in the L-band.

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44 *See ATC Order* at ¶ 215.

45 *See MSV Petition* at 12.

C. MSV Has Misinterpreted The Commission's Vocoder Analysis

MSV requests that the Commission clarify that the interference reduction factor it has assigned to the use of a quarter-rate vocoder and a quarter-rate channel applies to the operation of a half-rate vocoder and a half-rate channel.[46] MSV proposed to implement this request by substantially relaxing the EIRP/duty cycle schedule in the Commission's adopted rules. MSV asserts that this would achieve the 3.5 dB interference reduction used in the Commission's analysis.[47]

This proposal is specious. As discussed in Section 3 of the attached Technical Annex, MSV's proposal would result in double counting the interference reduction due to power control. MSV's analysis accounts for a power reduction due to both a decreased duty cycle and a power reduction due to power control. Because this power control reduction is already accounted for in the Commission's "Power Control Factor," MSV's analysis double counts its impact.[48] Therefore, the Commission should reject MSV's proposal and maintain its rules as adopted in the *ATC Order*.

II. DOWNLINK BAND INTERFERENCE

A. MSV Dramatically Under Estimates The Overload Threshold For Inmarsat Mobile Earth Terminals

The Commission adopted rules to protect Inmarsat's mobile earth terminals from interference generated by ATC base stations. In calculating the protection limits, the Commission assumed an overload threshold of –60 dBm for Inmarsat's METs.[49] MSV, in its petition, asserts that the Commission should use an overload threshold of –45 dBm based on

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46 *See MSV Petition* at 14.

47 *See MSV Petition* at Appendix E, proposed rule revision #2.

48 *See* Technical Annex § 3.

49 *See ATC Order* at App. C2, Table 2.2.1.3.A, 2.2.2.1.A and 2.2.3.2.A.

limited tests conducted solely on the measurement of the 1 dB compression point of the antenna/RF unit of various Inmarsat receivers. As explained in Section 4 of the attached Technical Annex, the analysis conducted by MSV in its petition is deficient because it ignores several crucial degradation effects of the Inmarsat METs and uses an inappropriate testing method.

In contrast, Inmarsat in its petition for reconsideration has provided reports from two separate Inmarsat receiver manufacturers (NERA and Honeywell), which provide detailed and accurate assessments of the thresholds applicable to Inmarsat's METs. Those studies demonstrate that a threshold of at most –75 dBm is necessary to protect Inmarsat METs from interference resulting from out-of-band signals that would transmitted by the proposed ATC base stations.[50] Specifically, NERA's analysis determined that the appropriate overload threshold for Inmarsat's latest and fastest growing MET, the Inmarsat Global Area Network terminal, is –75 dBm.[51] For Inmarsat's aeronautical terminals, the Honeywell report demonstrates that (i) the overload threshold is –72 dBm at 1 MHz frequency offset, and (ii) for offsets less than 1 MHz, the overload level is even lower.[52]

Because of the deficiencies of the MSV overload analysis, Inmarsat urges the Commission to ignore MSV's suggested overload limits and instead to recalculate the MET protection levels in the *ATC Order* based on the reports submitted by the manufacturers of the terminals. Unless the Commission adopts stricter limitations, the Inmarsat METs will suffer significant interference from the operation of the proposed ATC base stations.

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50 *See Inmarsat Petition* at 15-17.

51 *See id.* at Ex. A.

52 *See id.* at Ex. B.

B. Overhead Gain Suppression Standards Were Adopted Based On MSV's Proposal And Form The Basis Of Critical Analysis Underlying The *ATC Order*

In the *ATC Order*, the Commission adopted an integrated set of rules designed to protect Inmarsat from undue interference resulting from the deployment of ATC. MSV now requests that the Commission relax the required level of overhead gain suppression at ATC base stations because meeting the restrictions "will require L-band ATC operators to incur significant and unnecessary costs as well as production difficulties."[53] This restriction, however, is vital to the protection of Inmarsat aeronautical terminals, which are used in most commercial airliners and many private planes.

In its technical appendix, MSV asserts that "the base station antenna mask as presently specified by the Commission is very difficult to meet and commercially reproduce in large quantities."[54] The mask specifications, however, are consistent with those proposed by MSV in its original application.[55] MSV stated that it would use a "specially designed antenna" that would be able to perform to the specifications MSV offered. This representation was repeated in subsequent presentations when MSV responded to Inmarsat's assertions that MSV's specifications would not likely be achieved in practice.[56]

The Commission's adopted overhead gain suppression restrictions are based on detailed analyses performed by the Commission and the parties to this proceeding, including MSV, Inmarsat and the NTIA. In conducting these analyses, Inmarsat and the Commission

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53 *MSV Petition* at 19.

54 *MSV Petition*, Appendix D at 2, fn. 33.

55 *See MSV Application*, Appendix A at 27-29.

56 *See, e.g., Reply Comments of MSV* at 15-16 and attached CSS Antenna affidavit ("This makes this antenna a very cost effective choice for large scale Base Station deployment.").

relied upon the base station antenna performance standards asserted by MSV. Modification of those assumptions at this late point would call into question the results of all these analyses and require further detailed study by all parties before adequate conclusions could be drawn.[57] The aeronautical terminals protected by the Commission's overhead gain suppression restrictions provide important safety and navigation functions to airlines and deserve the highest level of protection. The Commission should not relax these standards simply because MSV asserts that the antenna mask it long advocated appears to cost more than MSV once anticipated.

C. Separate Distance And Aggregate PFD Level Restrictions Protect Safety Services Near Airports

In order to protect Inmarsat aeronautical terminals located on aircraft in the vicinity of airports from potential interference from ATC in the L-band, the Commission adopted rules that require ATC operators to locate base stations more than a certain distance from airports and to meet certain aggregate PFD levels at the edge of airport runways and aircraft stand areas.[58] The imposition of both rules provides necessary protection for Inmarsat aeronautical terminals that provide vital safety and navigation services to airlines.

The PFD limitation imposed by the Commission quantifies the interference level at which Inmarsat's aeronautical terminals will suffer unacceptable interference.[59] Verifying PFD levels, however, can be complex. As ATC base station configurations develop, ATC operators may exceed permitted PFD levels, accidentally or otherwise. Identifying and stopping

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57 *See* Technical Annex § 5.

58 *See ATC Order* at ¶ 154, Appendix C2 § 2.2.1.3.

59 As discussed above and the *Inmarsat Petition*, Inmarsat has demonstrated that the protections set forth in proposed rules 25.253(d)(3) and (4) underestimate the overload threshold for Inmarsat's aeronautical terminals. Therefore, Inmarsat has requested that the Commission modify its proposed rules to account for the correct overload threshold levels. *See Inmarsat Petition* at 15-17.

this interference would be very difficult for Inmarsat or the users of Inmarsat's aeronautical terminals. The location limitations set forth in adopted rule 25.253(d)(3) provides a critical further level of protection for these important safety services. The distance of an ATC base station from an airport is easy to verify. Distance alone, however, will not guarantee that the interference caused by ATC base stations into Inmarsat aeronautical terminals will be limited to acceptable levels. Therefore, it is only by combining the rules that the safety and navigation services provided by Inmarsat near airports can be protected.

The Commission's dual PFD limit and location limit rules are both appropriate and rational. Inmarsat requests that the Commission reject the request in MSV's petition and maintain the protection structures in proposed rules 25.253(d)(3) and (4), but modify the specific level of protection required as requested by Inmarsat in its petition for reconsideration.[60]

III. NON-FORWARD-BAND ATC OPERATIONS WOULD CAUSE SIGNIFICANT INTERFERENCE PROBLEMS

MSV has requested that the Commission "clarify" that non-forward-band ATC operations are permitted in the L-band.[61] Although MSV is not clear, by non-forward-band mode, Inmarsat assumes that MSV is seeking permission to operate its proposed ATC MTs such that they transmit in the L-band downlink frequency band and the base stations would transmit in the uplink band.

MSV does not explain why it has waited until this late point in the proceeding to raise this new proposal and why the Commission's rejection of a similar proposal by ICO, which was subject to significant comment in the proceeding, is not dispositive.[62] Now, as a seeming

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60 *See* Technical Annex § 6.

61 *See MSV Petition* at 23.

62 *See ATC Order* at ¶107.

afterthought, MSV has requested this extraordinary modification of the *ATC Order*. Because the issue could have been, but was not, raised in the proceeding, Inmarsat urges the Commission to reject MSV's request.[63]

As discussed in Section 7 of the attached Technical Annex, non-forward-band ATC operations would result in a direct interference path from the ATC MT to the receiving MSS MET. Where the physical space between the terminals was small, catastrophic levels of interference could result. Because of the mobile nature of the terminals – and the likelihood that they would operate in close proximity to one another – there are is no reliable way that MSS and ATC operators could ensure that interference would not occur. In addition, the use of both forward and non-forward-band ATC operations, as suggested by MSV for a Time-Division Duplex ("TDD") type of system, would be exceedingly complex in a multi-beam MSS/ATC system.[64]

Inmarsat's concerns are supported by the Commission's analysis of non-forward-band operations in the 2 GHz band. There the Commission found that:

> the Reverse Band Mode, and both Duplex Modes of operation for ATC, have significantly greater potential to interfere with other systems than the Forward Band Mode. Specifically, an ATC MT operating in Reverse Band Mode or the Downlink Duplex Mode, has the potential to interfere with other MSS MET receivers when the terminals are within approximately 300 feet of each other. ....The technical and operational constraints that would have to be placed on these Modes of ATC operation to protect in-band and adjacent allocation systems (e.g., coordination prior to operation, more stringent EIRP or out-of-band emission levels) would lessen the technical flexibility to effectively deploy ATC.[65]

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63 *See* 47 C.F.R. § 1.429(b).

64 *See* Technical Annex § 7.

65 *ATC Order* at ¶107; *see also id.* at Appendix C1 §2.2.4.1.

Based on its analysis, the Commission refused to authorize non-forward-band operations. Inmarsat urges the Commission to reach the same result with respect to the L-band and clarify that ATC operations are limited to forward-band operations only.

CONCLUSION

For the reasons set forth above, Inmarsat urges the Commission to deny MSV's Petition for Partial Reconsideration and Clarification.

Respectfully submitted,

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Technical Annex

1 Introduction

This Technical Annex responds to the points raised by Mobile Satellite Ventures Subsidiary LLC ("MSV") in its July 7, 2003 Petition for Partial Reconsideration and Clarification ("MSV petition") of the Commission's Report and Order and Notice of Proposed Rulemaking concerning Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band and the 1.6/2.4 GHz Bands ("the ATC Order").

Specifically this technical annex addresses the following claims that MSV makes in its petition:

1. MSV requests an increase of up to 17 times in the number of co-frequency uses of a particular ATC channel permitted within the US, and a corresponding increase in the level of allowable uplink interference into Inmarsat's satellites;

2. MSV requests that it not be constrained to operate an ATC system capable of reducing the vocoder rate to one quarter of full GSM rate, and claims that the 3.5 dB vocoder factor used by the FCC throughout its analysis is applicable to only half-rate vocoders;

3. MSV requests a 15 dB increase in the allowable EIRP of its ATC base stations based on MSV's erroneous assumptions about the sensitivity of the Inmarsat mobile terminals to overload;

4. MSV requests a relaxation of between 8 and 10 dB in the all-important overhead gain suppression of the MSV ATC base station antennas, which is contrary to MSV's earlier representations about the economically achievable performance of these antennas;

5. MSV requests that the Commission relax its rules about MSV ATC base stations in the vicinity of airports thereby increasing the risk of ATC interference to aircraft during take-off and landing;

6. MSV requests that the Commission now consider, for the first time during this proceeding, the possibility of ATC operating in the reverse transmission direction to that previously considered, which would result in a whole new scenario: catastrophic interference from the ATC mobile terminals into Inmarsat mobile terminals.

Each of these matters in addressed in a separate section below.

2 MSV requests up to a 17 times increase in the limit for co-frequency ATC base station transmissions

MSV requests that the Commission (a) increase from 1725 to 14,785 the recently adopted limit on the maximum number of co-frequency ATC base station transmissions in the US, and (b) consider a further doubling of this limit if MSV commits to implementing ATC only in the US. MSV is therefore effectively proposing an increase of up to 17 times in this crucial parameter.[1]

Any increase in the permitted number of co-frequency ATC base station transmissions in the US would directly increase the uplink interference to Inmarsat's satellite beams. Inmarsat remains concerned that the level of interference permitted by the *ATC Order* exceeds the level Inmarsat should have to accept. But, in any event, it is clear that the further increase in the level of interference proposed by MSV would compound the problem presented by ATC in the L-band, resulting in serious consequences for Inmarsat and its users in terms of loss of link margin and corresponding link performance.

MSV attempts to justify its proposed increase in the allowable number of co-frequency ATC base station transmissions in the US by a combination of several incorrect and inaccurate arguments. These MSV arguments are addressed individually in the sub-sections that follow.

2.1 MSV claims that the Commission calculated a total allowable number of 3450 co-frequency ATC base station transmissions and apportioned 50% of these to the US ATC system

MSV first attempts to double the number of allowable co-frequency ATC transmissions from 1725 to 3450 by claiming that the 3450 figure is really the total value calculated by the Commission. MSV then proceeds to argue that the Commission apportioned 1725 for ATC operating within the US based on a Commission assumption that only 50% of the total number of ATC base stations would be within the US.

MSV has the Commission's reasoning backwards. Nowhere in the ATC Order does the Commission calculate that a total of 3450 co-frequency ATC base station transmissions within the US should be the acceptable figure for interference either to Inmarsat or to MSV's own MSS system. The Commission calculated that a limit of 1725 co-frequency ATC carriers *within the US* is necessary to ensure that the $\Delta T/T$ in MSV's satellite beams is less than 6% (Section 1.14 of Appendix C2 of the Order). The Commission also concluded (Section 2.1.1 of Appendix C2 of the Order) that an additional 1725 co-frequency ATC carriers *outside the US* could be acceptable to Inmarsat. This does *not* mean that these additional 1725 carriers could be operated inside the

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[1] MSV's petition is not entirely clear in this respect. The MSV argument about doubling the limit if US-only ATC operation is guaranteed could be read as separate from its argument that the Commission's 1725 limit (which by its terms only addresses US ATC operations) should be increased to 14,785. Although each of these proposals should be rejected, for the reasons stated below, Inmarsat is also concerned that MSV appears to be proposing the combination of these two, which would result in a 17-fold increase in interference to Inmarsat.

US. The basis for the US limit is (1) that 173 co-frequency ATC MT transmissions in the vicinity of a particular MSV satellite beam would cause a 6% increase in the noise floor of that beam and (2) that there would be 10 co-frequency MSV satellite beams in the US.[2,3] Hence, the Commission's ATC limit is based on the assumption of an essentially uniform distribution of ATC MTs across the US. The increase in the limit proposed by MSV would lead to a higher density of MTs and consequently a $\Delta T/T$ greater than 6% for at least some MSV satellite beams.

Quite separate from the fact that the total number of co-frequency ATC base station transmissions from US territory was never calculated to be 3450, there is another aspect to this MSV tactic which causes serious concern. MSV is essentially offering to the Commission that it will only operate ATC in the US, and that therefore a larger cap should be placed on the number of co-frequency ATC base station transmissions. Does this mean that neither MSV, nor any other company (with which MSV may or may not have any affiliation) will ever operate ATC outside of the US? Clearly the Commission has to make a judgment about the aggregate effects of ATC uplink interference to Inmarsat satellite receivers from both the US and other countries. In this regard, note that Figures 1.11.A and 1.11.B of Appendix C2 of the ATC Order show the large geographic area where Inmarsat is vulnerable to the aggregate affects of ATC uplink interference, which encompasses the US as well as other countries such as Canada, the Caribbean, Central America and parts of South America. The Commission, although having no jurisdiction over territories other than the US, must establish precedent-setting rules in the ATC matter, which will adequately control the aggregate interference to Inmarsat (and other L-band MSS satellite operators). Wisely, the Commission already did so in the *ATC Order*.

In summary, the Commission should reject MSV's proposal on reconsideration and must clarify that the limit on the number of co-frequency ATC base station transmissions in the US is 1725 regardless of any commitments made by the operator concerning what it will or will not implement in the way of ATC systems in territories outside of the US.

2.2 MSV proposes a massive increase in its self-interference due to ATC and a corresponding increase in the uplink interference to Inmarsat

In all the record of this proceeding so far MSV has consistently claimed that its ATC system would protect the MSV MSS satellite system to a $\Delta T/T$ value of 6% (corresponding to a link degradation of 0.25 dB). In addition, Inmarsat has repeatedly warned of its concern that the self-interference from the MSV ATC system into the MSV MSS system could well be much higher than this. Inmarsat has explained that if this occurs then the capacity of the MSV MSS system will be reduced and MSV will be forced to use additional spectrum relative to that coordinated under the Mexico City MOU just in order to maintain the status quo in terms of the operation of

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2 That the MTs are in the "vicinity" of a beam here means that the average MSV satellite antenna discrimination towards these MTs is 10 dB.

3 It should be noted that the Commission's limit is already very generous, since it assumes that MSV will be able to achieve ten times frequency reuse among its satellite beams covering the US. If MSV does not achieve this level of reuse, its ATC operations will cause more than 6% noise increase into the MSV satellite system.

the MSV MSS system.[4] Nevertheless, MSV has consistently claimed that it can and will achieve the ΔT/T level of 6%. As a result the Commission assumed a self-interference ΔT/T value of 6% for MSV in its detailed analysis, and in the rules adopted in the ATC Order.

Based on MSV's latest petition it would appear that Inmarsat's fears about MSV's intentions were justified, and that the Commission's trust in MSV's assertions was misplaced. MSV is now proposing that its self-interference be capped at a ΔT/T level of 51%, a massive 8.5 fold increase over the previously asserted level of 6%.[5] This latest bombshell from MSV casts serious doubts about MSV's stated objective of operating a truly "ancillary" terrestrial system. Clearly MSV is more concerned with maximizing its terrestrial system capacity than with maintaining an adequate level of interference protection for its MSS system.

MSV attempts to justify the increased self-interference by the following arguments:

(a) MSV states that the MSV satellite will have at least 10dB of available uplink margin and so can accommodate 51% ΔT/T due to self-interference.

Link margin in any satellite link is always an expensive commodity because of the inherently long signal path between the Earth and the satellite. It is necessary to conserve both satellite transmit power (for downlinks) and earth station transmit power (in the case of the uplinks from the mobile terminals). Therefore link margin is only created in sufficient quantity to overcome the assumed impairments and thereby guarantee the required high service quality to the users. To throw away as much as 1.8 dB of link margin because of ATC uplink interference therefore defies the common sense rules of satellite system design. By apportioning this much interference to ATC, MSV would effectively have to increase the transmit power of the mobile earth terminals by more than 50%, which is clearly undesirable from the point of view of deploying a truly competitive terrestrial service offering due the adverse impact on mobile earth terminal cost, size, power consumption (i.e., battery lifetime), transmission data rates, etc. In addition, by transmitting more power from the mobile earth terminals, more interference is caused into other satellite uplinks, thereby worsening the international frequency coordination problem. Of course, by building a satellite with a larger number of smaller beams than would otherwise be necessary, the additional link margin could be recovered, but this results in a more expensive satellite, so in the end the users will pay a higher price for service. For all of these reasons, the MSV willingness to apportion such a large amount of link margin to overcome its own ATC self-interference clearly signals MSV's real priorities to favor its terrestrial business interests over its satellite and terrestrial business interests.

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4 In addition to this Inmarsat previously has also shown that MSV's ATC system will require in some geographic areas additional spectrum to that used by the MSV MSS system, simply because there is insufficient satellite antenna discrimination for the proposed MSV ATC system to re-use the satellite spectrum.

5 With the additional doubling of the number of reuses proposed by MSV based on a potential commitment from MSV to implement ATC only in the US, the self-interference would reach the even more remarkable level of 102%.

(b) MSV states that it has yet another proprietary technique that overcomes the fundamental interference problems of its proposed ATC system.

Throughout this proceeding MSV's creativeness at proposing novel (yet proprietary, and therefore not fully disclosed) techniques to try to overcome the inherent and fundamental interference problems of its proposed ATC system has been remarkable. Inmarsat has commented on previous examples of this in its earlier pleadings and will not repeat those comments here. Now, in MSV's latest petition it proposes a possible self-interference mitigation technique that employs two in-orbit satellites. We are left only to imagine how such a multi-beam system might work in practice, considering that it is orders of magnitude more complex than the simple DARS systems that use space diversity in the outbound direction only. Furthermore, the use of an additional in-orbit satellite and the ground infrastructure necessary to implement the satellite diversity technique, has huge cost repercussions for the satellite system, and therefore likely price implications for the end users of the system. For these reasons, we do not believe this suggested ATC interference mitigation technique can be seriously considered by the Commission as a realistic way to overcome the problems caused by the 8.5 times increase in self-interference that MSV is now proposing.

There is also another important aspect to MSV's proposal to increase its self-interference from ATC, which is that the uplink interference to Inmarsat will increase also by 8.5 times. MSV argues that the resulting interference to Inmarsat will reach a level corresponding to a $\Delta T/T$ of 6% (which Inmarsat disputes – see below), and that this level should be acceptable to Inmarsat (which Inmarsat also disputes as explained below).

The Commission has calculated two $\Delta T/T$ values for interference from ATC (from within the US) to Inmarsat-4: in Section 2.1.1 the Commission calculated a $\Delta T/T$ of 0.7% and added that if an additional 1725 co-frequency carriers are operated from Canada then the aggregate $\Delta T/T$ would be 1.4%; in Section 2.1.2 the Commission calculated the figure of 3.4% $\Delta T/T$ to Inmarsat.

Adopting the lower Section 2.1.1 calculation as a basis, MSV has asserted that ATC operations should be allowed to cause a 6% noise increase in the Inmarsat-4 satellite. This would then result in a noise increase of $(6/0.7)*6 = 51\%$ in the MSV satellite. However, this does not take into account any interference from ATC outside the US. If we assume, as the Commission has done, that an equal number of ATC base stations are implemented outside the US (e.g. in Canada), then the noise increase in the Inmarsat-4 satellite would be 12%. Of course, if we adopt the Section 2.1.2 calculation as a basis, the noise increase in the Inmarsat-4 satellite resulting from MSV's new proposed ATC limits would be $8.5*3.4\% = 29\%$. Either of these interference levels is totally unacceptable and far beyond what the Commission contemplated in reaching its decision.

Inmarsat reiterates here what it has stated many times in this proceeding. There is no rationale for why the global primary MSS service should accept a 6% increase (let alone 12% or 29%) in its noise level due to the operation of a non-conforming domestic terrestrial system such as ATC. The Inmarsat satellite system is constantly striving to provide the best quality service to the many different types of users around the world, and the availability of interference-minimized

spectrum is key to this. It is completely inappropriate for Inmarsat to be required to accept ATC interference corresponding to a ΔT/T value of 6% and Inmarsat objects strongly to this latest MSV attempt to force Inmarsat to accept such an interference level.

MSV states that "it is normal for satellite systems to accept greater levels of interference than 6% ΔT/T". In fact, the 6% criterion is commonly used in satellite frequency coordination, including L-band satellite network coordination. Inmarsat bases its reuse constraints with other operators (including MSV) on C/I criteria based on 6% ΔT/T, although exceptions are sometimes made on a case-by-case basis. In particular, such exceptions may be made when the relevant (worst case) carrier combinations are unlikely to occur in practice. However, it would not be possible in satellite coordination to generally accept single-entry interference levels significantly above 6% ΔT/T. As already discussed above, the interference margin in satellite systems is limited. Normally, a 1 dB aggregate allowance is made for intersystem interference from all other systems.[6] This corresponds to an aggregate ΔT/T level of about 25%. It is obvious that as the number of interferers increases, it becomes more important to ensure that each interferer is limited to a reasonable interference level. Inmarsat has to account in its link budgets for interference from all other L-band satellite networks - there are currently over 20 satellites operating at L-band and the number is growing. With increasing use of the spectrum by satellite systems, the interference margin that could be made available for other sources of interference (such as ATC) is less.

MSV says that Inmarsat "can and does tolerate more than a 6% rise in its noise floor" and refers to the ATC Order (164) where the Commission quotes a "typical" noise increase in the Inmarsat-3 satellites of 29%.[7] This value is taken out of context. The 29% figure comes from an Inmarsat document which compared the interference levels caused by the current and next generation MSV satellites.[8] As the calculation in the Inmarsat document was performed to illustrate the *relative* levels of interference from the current and next generation MSV satellite systems, it was not intended to be, and was not, a typical case. The MSV carrier parameters used were only one

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6 MSV states that it believes Inmarsat-4 will have "at least 4 dB of available link margin even after accounting for all non-ATC intra- and inter-system interference sources". This statement requires a response to put the record straight. Satellite services for *handheld* units are known to require very large link margins, due to frequent partial obstruction of the antenna by the user, and to the very severe multipath and fading conditions experienced in the link. That is not the case for Inmarsat, which does not provide handheld services. Operation of the Inmarsat terminals requires clear line-of-sight to the satellite. As a result, Inmarsat employs link margins typically in the 2 dB to 3 dB range, depending on the type of terminal. These link margins are necessary to cope with the satellite channel propagation conditions, and are fully utilized to keep the intended quality of service during the duration of a call. It would be desirable to reduce these margins, as that would translate into less expensive terminals, higher satellite capacity and higher revenues; however no reduction in these margins is feasible without impacting the quality of the service Inmarsat provides to its users, and that would be totally unacceptable. Inmarsat owes it to its existing users to continue providing a high quality service, with no increase in costs, and will continue to apply the same philosophy to its BGAN users on the Inmarsat-4 satellites. Therefore, the small link margins that are planned for Inmarsat-4 services cannot be used to accommodate interference from secondary services, such as ATC. Such external interference has to be accommodated in the 1 dB margin that is provided for that purpose.

7 See MSV Petition at 14.

8 See Inmarsat *ex parte* "Quantification of Harmful Co-Channel Uplink Interference into Inmarsat-4 From MSV ATC Uses, Versus MSV Mobile Earth Terminal Uses", IB Docket No. 01-185 (filed May 9, 2002).

example of many different carrier types used in the MSV system, most of which have a lower EIRP spectral density. Further, as is common practice in frequency coordination, the maximum EIRP value was used, rather than the nominal value, i.e. this value is based on the worst-case scenario. Hence, the typical interference levels actually received by Inmarsat-3 from the MSV system are significantly lower than the 29% ΔT/T shown in this illustrative calculation.

Further, the MSV proposals only relate to the interference caused by the MSV ATC system and do not consider the interference from the MSV satellite system. MSV's next-generation system should be treated as one system with two components (satellite and terrestrial), where the terrestrial component is integrated with and ancillary to the satellite component. Therefore, the interference level from MSV's combined satellite and ATC system needs to generally be maintained at levels around 6% ΔT/T (with appropriate exceptions that may be agreed to in frequency coordination).

3 MSV claims half-rate vocoders will achieve the same 3.5 dB interference reduction as quarter-rate vocoders

In proposed rule revision #2 of Appendix E of the MSV Petition, MSV proposes a substantially relaxed EIRP/duty cycle schedule and claims that this would achieve the 3.5 dB interference reduction used in the Commission's analysis. The MSV proposal, however, is based on a misunderstanding of the Commission's analysis and would lead to double counting of interference reductions due to power control.

Two factors used by the Commission in Table 1.14.A of Appendix C2 of the Order are relevant here: the "Power Control Factor" and the "Vocoder Factor". The Power Control Factor accounts for the reduction in interference power due to ATC MT power control and structural attenuation, while the vocoder factor accounts for the reduction in interference power due to the duty cycle of the ATC MT transmissions. With respect to the Power Control Factor, the Commission has adopted a requirement for an 18 dB building attenuation margin for ATC systems. Based on this, the Commission concludes that the applicable power control factor for ATC mobiles at the edge of a cell is 18 dB.[9,10] In addition, the Commission takes into account a range taper factor of 2 dB, resulting in the total Power Control Factor of 20 dB. The Vocoder Factor accounts for the reduction in (average) interference power by 3.5 dB due to the duty cycle of the transmissions, as illustrated in Table 1.10.B of Appendix C2 of the Order.

The MSV proposed relaxation of the ATC MT EIRP/duty cycle schedule is based on an analysis that accounts not only for the power reduction due to the duty cycle but also includes a power reduction due to power control. Since this power control reduction is already accounted for in the Commission's Power Control Factor, the MSV proposal would lead to double counting. The vocoder factor (as defined by the Commission) resulting from the MSV proposed schedule

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9 *See ATC Order* App. C2 § 1.3.1.

10 As discussed in our Petition, Inmarsat disagrees with this conclusion.

would be less than 3.5 dB.[11] For these reasons, the Commission should reject the modified EIRP/duty cycle schedule proposed by MSV.

4 MSV claims that Inmarsat mobile terminals are 15 dB more resilient to overload than the Commission assumed, and 30 dB more resilient than demonstrated by manufacturers' data

In the ATC Order the Commission assumed an overload threshold for Inmarsat mobile receivers of –60 dBm. In the Inmarsat Petition, Inmarsat provided two reports from two separate Inmarsat receiver manufacturers (NERA and Honeywell), which demonstrate that a threshold value of at most –75 dBm is necessary to protect Inmarsat receivers from interference due to nonlinear effects, including small signal suppression and intermodulation product interference, arising from out-of-band signals transmitted by the proposed ATC base stations. In the latest MSV petition, MSV again asserts that the appropriate threshold value to use for out-of-band interference is –45 dBm.

MSV's latest assertion regarding the appropriate threshold level is based solely on the measurement of the 1 dB compression point of various Inmarsat receivers. This is not a satisfactory way of assessing the interference that can result from adjacent channel signals due to the nonlinearity of the front-end of the Inmarsat receivers. The 1 dB compression point is a measure of the departure from linear performance, but it does **not** indicate the level below which no interference occurs. In particular, interference due to 3rd order intermodulation products generated by the nonlinearity of the Inmarsat receiver, either by the front-end amplifier or by the first mixer, will occur at input levels significantly below the 1 dB compression point. For this reason the MSV results, which only take account of the 1 dB compression point, are meaningless in this assessment of adjacent channel interference. After consultation with the Inmarsat terminal manufacturer NERA, Inmarsat has the following detailed comments on the latest MSV measurements.

MSV's test method is inappropriate

MSV's test method is based on measuring the 1 dB compression point between the input and output of the NERA mini-M Worldphone Antenna/RF unit by applying a single high-powered signal and measuring the output at an intermediate frequency (IF). This method is inappropriate because:

- it ignores the effect an interfering signal will have on the demodulation of a wanted signal
- it ignores the generation of harmonic signals and the resulting intermodulation effects created by non-linearities when applying more than just one signal at the receiver input

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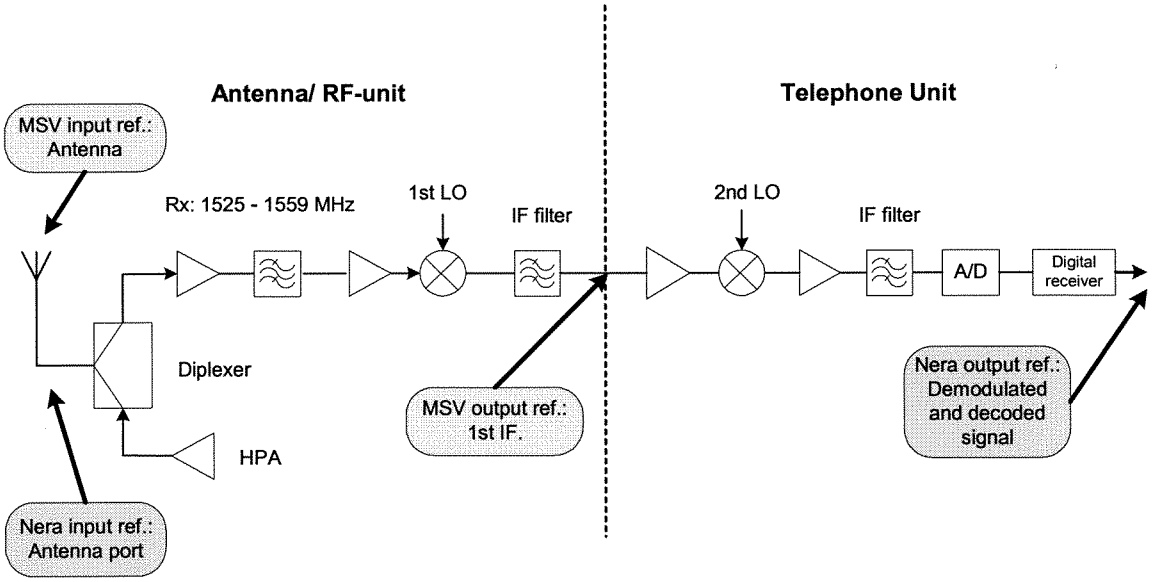
[11] Assuming the same distribution of users as that assumed by the Commission, i.e. 30% of users outdoors, 30% of users in cars and 40% of users indoors, the Vocoder Factor that would result from the schedule proposed by MSV would be 10log(30%*100%+30%*100%+40%*50%) = -1 dB. It can be noted that MSV's statement that the distribution of users is not relevant in the uplink analysis is incorrect. The distribution is required to assess the Vocoder factor, as shown above.

- it ignores the degradation effects that will be suffered by the elements that are further down the receiver chain such as A/D converter, amplifiers, downconverters and filters.
- it ignores the increased composite power level applied to the A/D converter.

The shortcoming of MSV's test method becomes apparent when considering NERA's actual mini-M receiver architecture (see Figure below) which is separated in an Antenna/RF unit and Telephony (or modem) unit with an IF-interface in between.



As can be seen from the figure there are a number of important and sensitive receiver elements below the IF which MSV has used as output reference point. All the receiver elements to the right of the dotted vertical line are effectively left untested by MSV's test method.

Design engineers at NERA have indicated to Inmarsat that saturation of the A/D converter as well as intermodulation harmonics created in the second downconverter are likely to be the most interference sensitive elements in their Worldphone receiver chain. Tests previously carried out by NERA on their Worldphone mini-M receiver indicate that an interfering signal of –60 dBm (at the antenna input) at an offset of 200 kHz away from the wanted signal, caused significant degradation on the voice service, hence forming harmful interference.

To conclude, MSV's method is completely inappropriate to benchmark actual effects of interferer degradation on demodulated signals. To make such a benchmarking appropriately one needs, as a minimum, to consider

- the whole receiver chain, not just selective parts of it
- the effect of intermodulation caused by receiver non-linearities
- the effect of power overload at the A/D converter input

The GAN tests carried out by NERA[12] take these factors into account, and thereby gives a "real-world" benchmarking of receiver sensitivity.

MSV's description of Inmarsat terminal testing is incomplete
MSV's description of their tests of Inmarsat terminals [App C of MSV Petition] has several shortcomings:

- Figure 2 fails to show that there are downconversion stages both in the RF unit and the modem unit
- Figure 2 fails to show that there is an ADC in the modem unit
- From Figure 2 and the text, it appears that MSV has just measured power level at "Pout", thus ignoring other signal characteristics (e.g. phase response, frequency response) that clearly are important for signal quality and the receiver's capability to demodulate the signal.

To conclude, the MSV Petition demonstrates that MSV has not fully understood the receiver design of the terminals it has been testing and also fails to present their own test environment clearly.

MSV's selection of products for testing is inappropriate
MSV has selectively chosen to not test GAN which expectedly will be most interference sensitive of the Inmarsat products, due to its wide receive-filter bandwidths.

As the NERA test report included in the Inmarsat Petition concludes, the harmful interference threshold for the GAN Worldcommunicator terminal is in the order of –73 to –74 dBm assuming a single interfering carrier 300 kHz away from the wanted signal.

Inmarsat therefore strongly urges the Commission to ignore the claims made by MSV in this regard, but rather to take heed of the warnings presented by both NERA and Honeywell, both well established manufacturers of Inmarsat terminals. As a result of this the Commission should make appropriate changes to the proposed ATC rules to take account of the 15 dB shortfall between the –75 dBm level indicated by NERA and Honeywell, and the level assumed previously by the Commission. This will entail a reduction in the allowable ATC base station aggregate EIRP levels and/or an increase in the minimum ATC base station separation distances from areas where Inmarsat mobile terminals will be used.

5 MSV claims that it needs to relax the overhead gain constraint on the ATC base station antenna by between 8 dB and 10 dB compared to the performance levels previously proposed by MSV

MSV claims in its latest petition that the overhead gain mask proposed by the Commission in the ATC Order is overly restrictive and "... will require L-band ATC operators to incur significant and unnecessary costs as well as production difficulties in deploying base stations". This is remarkable considering that the Commission's proposal in this regard is completely consistent with the original MSV application for its ATC system, where this mask is provided for the MSV

[12] See Inmarsat Petition at Ex. A.

"specially designed antenna", and further assertions by MSV in subsequent pleadings that this level of performance will be achieved.

It is important to note that all the detailed analyses performed by the Commission and others (including Inmarsat and NTIA) of potential interference from ATC base stations to aircraft in flight have been based on the overhead gain mask proposed by MSV. It is therefore inconceivable that the Commission could entertain a significant relaxation in this crucial gain mask at such a late stage in the proceeding, despite the last-minute results presented by MSV. With safety of life issues at stake Inmarsat strongly urges the Commission to reject this latest ruse of MSV.

6 MSV seeks a relaxation in the constraints on ATC base stations in the vicinity of airports

MSV requests the Commission to change the proposed rules in 25.253(d)(3) and (4) which are intended to provide interference protection to aircraft in the vicinity of airports from interference from the ATC base stations. MSV's specific request is that one or the other of these two rules should apply, but not both.

In preparing the proposed ATC rules we presume the issue of interference to aircraft in the vicinity of airports was considered by the Commission to be extremely important, for safety of life reasons, and Inmarsat concurs with the approach taken. Therefore, by imposing both the separation distance rule and the PFD limit rule, the Commission is erring on the conservative side. If only one or the other rule were applied, there would be increased risk of harmful interference to the aircraft receivers from the ATC base stations. Clearly the separation distance rule is the easiest one for the Commission to verify in practice, and this gives a degree of security in its own right. However, the PFD limit rule better quantifies the interference causing potential of the ATC base station, but is more complicated to verify, and is subject to violation, accidental or otherwise, over time, as the base station configuration evolves.

Therefore, Inmarsat urges the Commission to maintain the currently proposed rules in this regard, at least in terms of rule structure. However, in these rules the separation distance needs to be increased, and the PFD value reduced, in order to reflect the lower actual threshold values discussed in Section 4 above.

7 MSV requests that ATC be allowed to operate in either transmission direction (BS-to-mobile or mobile-to-BS) in both uplink and downlink L-band MSS allocations

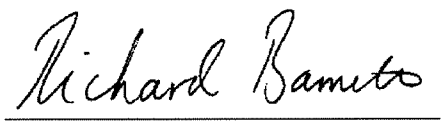
MSV requests in its latest petition that the Commission clarify that non-forward-band ATC is permitted in the L-band. By this we assume MSV means that it wishes to use transmissions from its ATC mobile transmitters that operate in the part of the L-band allocated to space-to-Earth (i.e., downlink) MSS transmissions. MSV requests that the Commission invoke the requirement that the L-band ATC operator planning to use non-forward-band ATC demonstrate that its system causes no greater interference than forward-band ATC.

This is a very strange request, given the record in this proceeding so far, and it would appear to be an afterthought on MSV's part. Clearly this non-forward-band ATC operation would give rise to a direct interference path from the transmitting ATC mobile terminal to the receiving MSS mobile terminal. With both transmitting and receiving terminals being truly mobile, there are clearly many situations that would arise where the physical spacing between the transmitting interferer and the receiving victim is very small, resulting in catastrophic levels of interference. The principles of minimum physical separation embodied in the proposed Commission ATC rules would be useless in this situation, and there would be no reliable mechanism to avoid the possibility of interference. It is also difficult to see how MSV could avoid self-interference problems between its ATC system and its MSS system. The only reliable way would be to employ a universal system-wide clock where all satellite downlink transmissions cease during the period when the ATC non-forward-band transmissions are taking place. Such an approach would inevitably reduce the throughput of the satellite system, but this would appear from the record in this proceeding to be something that MSV is not unduly concerned about.

Inmarsat therefore strongly urges the Commission not to entertain such an extreme proposal as non-forward-band ATC at this late stage in the proceeding.

CERTIFICATION OF PERSON RESPONSIBLE FOR PREPARING ENGINEERING INFORMATION

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in the foregoing submission, that I am familiar with Part 25 of the Commission's rules, that I have either prepared or reviewed the engineering information submitted in this pleading, and that it is complete and accurate to the best of my knowledge and belief.



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Dated: August 20, 2003

CERTIFICATE OF SERVICE

I, Alexander Hoehn-Saric, hereby certify that on this 20th day of August, 2003, the foregoing "Inmarsat Opposition To Petition For Partial Reconsideration And Clarification Of Mobile Satellite Ventures Subsidiary LLC" was filed electronically on the FCC's Electronic Comment Filing System and a copy was served by e-mail and via first class mail, postage pre-paid, upon the following:

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